# EXECUTIVE SUMMARY

Bechtel Environmental, Inc., has prepared this Feasibility Study (FS) Report on behalf of the Department of the Navy Base Realignment and Closure Program Management Office West, in accordance with Contract Task Order 0069 issued under the Comprehensive Long-Term Environmental Action Navy 3 Program, Contract No. N68711-95-D-7526. The Navy, under the Defense Environmental Restoration Program, follows guidance for FS report preparation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Figures and tables are included at the end of this summary.

Installation Restoration (IR) Program Site 27, referred to as the Dock Zone, is located in Alameda Point (formerly Naval Air Station Alameda). Alameda Point is located on the western tip of Alameda Island, which is on the eastern side of San Francisco Bay (Figure ES-1). IR Site 27 is an approximately 15.8-acre site located in the southeastern area of Alameda Point adjacent to Seaplane Lagoon (Figure ES-2). In September 1993, Naval Air Station Alameda was designated for closure by the United States Congress and the Base Realignment and Closure Commission. The base officially closed in April 1997.

This FS Report develops and evaluates remedial action alternatives to address human-health risks from groundwater underlying IR Site 27 that contains chlorinated volatile organic compounds (VOCs) at concentrations above applicable regulatory comparison criteria. The Remedial Investigation (RI) Report for IR Site 27 recommended preparation of this FS Report to address only the chlorinated VOCs in groundwater. As concluded by the RI Report, no immediate threat to human health or the environment from soil was found at the site. The RI Report also concluded that no further action was warranted for terrestrial or aquatic life ecological receptors.

The chlorinated VOC plume at IR Site 27 is depicted on Figure ES-3. The plume underlies most of the site and is contained within the boundaries of the site. Groundwater underlying the site is not used for domestic purposes. Risk assessment results indicated that only the human-health risk that would be associated with the domestic use of groundwater at the site (specifically, ingestion and showering) would exceed the risk management range of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

## SITE BACKGROUND

Potential sources of the VOCs in groundwater at IR Site 27 include the historical and current operations conducted within the boundaries of the site, and, less likely, the release of VOCs to groundwater upgradient of IR Site 27. Historical operations included ship docking, repair, and painting; equipment and materials staging and storage; vehicle washdown; and chemical storage and handling in Building 168. Current operations by tenants leasing space at IR Site 27 are generally similar to historical operations.

Groundwater at IR Site 27 is not used as a drinking water source, but a portion of the first water-bearing zone (inland) is classified as a potential drinking water source for upgradient off-site wells. Sixty wells located upgradient of the southeastern portion of Alameda Point are screened in the Merritt Sand. These wells are located up to 1 mile east of Alameda Point (i.e., east of Main Street). Most of these wells were installed during the

1970s to provide a supplemental source of irrigation water for homeowners on Alameda Island; some of these wells are still in use. A sheet pile bulkhead, installed in conjunction with the construction of Seaplane Lagoon and the hydraulic filling of the area that is now IR Site 27 may still be present beneath IR Site 27 at a location approximately beneath Ferry Point Road (Figure ES-3). Groundwater from shoreline wells (west of the sheet pile bulkhead and Ferry Point Road) does not meet criteria for a drinking water source due to high total dissolved solids (TDS) concentrations and close proximity to the shoreline. Groundwater from wells in the central and eastern portions of IR Site 27 (inland wells) contains freshwater levels of TDS. For FS purposes, the bulkhead is used as the dividing point between groundwater with elevated TDS levels (shoreline wells) and freshwater TDS levels (inland wells).

The human-health risk assessment (HHRA) that was presented in the IR Site 27 RI Report evaluated the risk to receptors based on the planned future use of IR Site 27 as "mixed use," including marina and inner harbor areas that will allow residential, recreational, commercial, and light industrial use. For the occupational and construction scenarios, the cancer risk and noncancer hazard values are within the NCP risk management range. For hypothetical future residents, United States Environmental Protection Agency (U.S. EPA) and California Environmental Protection Agency (Cal/EPA) reasonable maximum exposure cancer risk values exceed the NCP risk management range for two exposure pathways (assuming domestic use of on-site groundwater): ingestion and dermal contact while showering. The primary risk drivers in groundwater are arsenic, vinyl chloride, and PAHs. The primary risk driver in soil gas is TCE. The primary risk driver in soil is arsenic, which is present at concentrations comparable to Alameda Point background.

The ecological risk assessment (ERA) presented in the IR Site 27 RI Report evaluated the risk to ecological receptors through direct soil contact and the food chain as well as through groundwater releases to surface water. The results of the ERA indicate negligible risk to terrestrial wildlife receptors from chemicals in soil and low risk to benthic fish and invertebrates from chemicals in groundwater, based on current conditions and planned future use of IR Site 27. The ERA provides a protective overestimate of the actual risk of adverse ecological effects to aquatic life organisms in surface water adjacent to IR Site 27 because of the conservative nature of the assumptions used (i.e., maximum concentrations of chemicals in groundwater were compared to California Toxics Rule criteria continuing concentrations [CCCs]).

Due to the expansion of the IR Site 27 boundaries to encompass the VOC plume, a washdown area (WD-166 and related oil/water separators) and Building 555 (an electrical substation) were included within the IR Site 27 boundaries. The RI Report identified data gaps associated with testing groundwater at the washdown area and with testing for polychlorinated biphenyls in soil adjacent to Building 555. These data gaps are to be addressed during the remedial design phase.

# REMEDIAL ACTION OBJECTIVES

The general response objectives for IR Site 27 are as follows.

- Protect beneficial uses of groundwater underlying IR Site 27.
- Protect beneficial uses of surface water adjacent to IR Site 27.
- Protect human health by prohibiting domestic use of groundwater that has been impacted by chemicals of concern (COCs) until the Navy, the U.S. EPA, the Cal/EPA Department of Toxic Substances Control (DTSC), and the San Francisco Bay Regional Water Quality Control Board (RWQCB) concur that there is no longer an unacceptable risk from such exposure.

Groundwater beneath the site is not used for drinking water. However, shallow inland groundwater (more than 100 feet from the shoreline and east of Ferry Point Road and the sheet pile bulkhead) currently meets U.S. EPA criteria (i.e., TDS concentration and yield) for a Class II aquifer. Groundwater west of the sheet pile bulkhead (shoreline groundwater) meets both U.S. EPA and RWQCB criteria for a nonpotable (non-drinking) water source.

Remedial action objectives (RAOs) for groundwater inland of the bulkhead were developed based on potential domestic use of groundwater. RAOs for shoreline groundwater are based on California Toxics Rule criteria for human health (consumption of organisms). RAOs are shown in Table ES-1. No surface water RAOs for aquatic receptors are selected for IR Site 27 because of the lack of significant ecological risk to aquatic life organisms, as established by the ERA conducted at IR Site 27.

The current site use is occupational. Health risk associated with indoor air exposure (for occupational use) is within the NCP risk management range. In the context of the general response objectives above, the potential exposure pathways are summarized as follows.

- There are currently no human populations exposed to VOC-impacted shallow groundwater at IR Site 27.
- The RI Report concluded that groundwater discharging to the Seaplane Lagoon may contain VOCs that could impact the surface water of the Seaplane Lagoon/San Francisco Bay.

It is unlikely that future site occupants would extract groundwater for beneficial use at IR Site 27. However, for the purposes of this CERCLA cleanup, maximum contaminant levels (MCLs) are potential ARARs for inland groundwater.

There were no potential ARARs identified related to wetlands protection, floodplain management, hydrologic resources, or geologic characteristics. However, the site is within the coastal zone, so the substantive provisions of the Coastal Zone Management Act are potentially relevant and appropriate. Because of the absence of substantial ecological habitat at IR Site 27, listed species of the federal Endangered Species Act are unlikely to be present; therefore, the Endangered Species Act and California Fish and Game Code Section 2080 are not potential ARARs. The Migratory Bird Treaty Act is potentially relevant and appropriate because listed birds may land on the site.

# SCREENING OF REMEDIAL TECHNOLOGIES

Remedial technologies for consideration in this FS Report have been identified based on U.S. EPA guidance, remedial technology literature, and Alameda Point experience. Remedial technologies that were carried forward to the detailed analysis of alternatives in this FS Report are summarized below.

## No Action

No action is included as an option because it is the baseline for comparison with other response actions.

## Institutional Controls

ICs may restrict the use of groundwater and prohibit activities that could result in unacceptable exposure to groundwater COCs.

## Monitored Natural Attenuation

Monitoring may include technical measures such as groundwater sampling and analysis to evaluate the extent and migration of COCs, potential risks, and/or changes in site conditions over time. Groundwater monitoring may be employed for a limited time to document site conditions or over a long-term period to track changes over time.

Monitored natural attenuation (MNA) is a process option that employs monitoring to confirm the effectiveness of naturally occurring *in situ* processes (e.g., biodegradation, chemical transformation, volatilization, dilution, dispersion, and adsorption) in achieving RAOs within a reasonable time frame. Under certain conditions, these natural processes act to reduce the mass, toxicity, mobility, or volume of COC-contaminated groundwater. Monitoring is performed to check the progress of attenuation processes.

## *In Situ* Treatment

*In situ* treatment refers to technologies used to treat contaminated groundwater in place (below grade), using physical, biological, thermal or chemical treatment technologies.

# REMEDIAL ALTERNATIVES

Ten remedial alternatives for groundwater are developed and screened, and six are retained for detailed analysis. The groundwater alternatives that were considered in this FS Report are summarized in Table ES-2. The alternatives retained after screening are described below.

The duration of each alternative is estimated based on groundwater model simulations obtained using the BIOCHLOR Natural Attenuation Decision Support System (BIOCHLOR). BIOCHLOR is a U.S. EPA-accepted screening model that simulates remediation by natural attenuation of dissolved solvents at sites with chlorinated VOC releases.

## Alternative 1 – No Action

For this alternative, no further action of any type would be implemented for groundwater. This alternative is included in accordance with the NCP, and serves as a baseline against which the other groundwater alternatives can be evaluated.

## Alternative 3 – MNA and ICs

Alternative 3 would utilize MNA and ICs to address the chlorinated-VOC-impacted groundwater. This alternative relies on natural processes to continue to reduce contaminant levels in the plume at IR Site 27. A long-term groundwater monitoring program, including periodic reviews, would be implemented to track the reduction in contaminant concentrations. ICs would prohibit groundwater extraction at the site. ICs would also prohibit actions that would interfere with MNA activities. BIOCHLOR model simulations predict that RAOs would be achieved in 70 years for this alternative.

## Alternative 4A – ISB Source Area Treatment, MNA, and ICs

Alternative 4A is similar to Alternative 3, but would additionally employ anaerobic *in situ* bioremediation (ISB) technology to accelerate VOC contaminant degradation in the IR Site 27 plume. It is assumed that Hydrogen Release Compound (HRC) technology would be used to accelerate biodegradation of VOCs. HRC would be injected into the source area aquifer zone in the areas shown on Figure ES-4.

MNA for Alternative 4A would be similar to Alternative 3 except that the duration is assumed to be 60 years, based on BIOCHLOR model simulations. ICs would be similar in scope to Alternative 3.

## Alternative 6A – ISCO Source Area Treatment, MNA, and ICs

Alternative 6A would accelerate contaminant concentration reduction using *in situ* chemical oxidation (ISCO) to oxidize VOCs in groundwater in two treatment areas (Figure ES-4) in the IR Site 27 plume. The ISCO process would be employed to destroy contaminants in groundwater. One treatment event for both treatment areas is assumed, plus one additional "hot spot" injection event.

MNA for Alternative 6A would be similar to Alternative 3 except that the duration is assumed to be 45 years, based on BIOCHLOR model simulations. ICs would be similar in scope to Alternative 3.

## Alternative 6B – Sitewide ISCO Treatment and Groundwater Confirmation Sampling

Alternative 6B would use ISCO to aggressively treat the entire IR Site 27 plume to reduce VOC concentrations to achieve RAOs. The process assumed for Alternative 6B would be employed across the entire inland area of the estimated 11-acre plume (Figure ES-5). If needed, a subsequent hot spot injection event would be performed at up to one-half of the full-scale injection points.

The assumed duration for Alternative 6B is 3 years. This includes an assumed 75-day treatment period followed by 3 years of groundwater confirmation sampling to document post-ISCO-treatment VOC concentrations in groundwater.

### Alternative 7 – Dynamic Circulation Source Area Treatment, MNA, and ICs

Alternative 7 uses an innovative source area treatment technology. Dynamic Subsurface Circulation well technology utilizes in-well air sparging, in-well air stripping, and soil vapor extraction. This combination of technologies creates circulation of treated groundwater outward from the treatment well through capillary fringe soil and returning into the well for treatment. It is assumed that ten 6-inch-diameter remediation wells and two remediation systems would be installed in the two treatment areas (Figure ES-4): one just east of Ferry Point Road and one outside the western edge of Building 168.

MNA for Alternative 7 would be similar to Alternative 3 except that the duration is assumed to be 55 years, based on BIOCHLOR model simulations. ICs would be similar in scope to Alternative 3.

## COMPARATIVE ANALYSIS OF ALTERNATIVES

The relative performance of the retained remedial alternatives considered in this FS Report were compared against the NCP evaluation criteria in order to assess the merits of each alternative and identify key trade-offs the Navy must consider when selecting a cleanup remedy. The NCP criteria are as follows:

- threshold criteria
  - overall protection of human health and the environment
  - compliance with ARARs
- primary balancing criteria
  - long-term effectiveness and permanence
  - reduction of toxicity, mobility, or volume through treatment
  - short-term effectiveness
  - implementability
  - cost
- modifying criteria
  - state acceptance
  - community acceptance

Since the NCP threshold criteria must be satisfied for a remedial alternative to be eligible for selection unless an ARAR waiver applies, the selection of eligible remedial alternatives will generally be based on a comparison of how well an alternative meets the

five primary balancing criteria and the two modifying criteria. Except for Alternatives 1 and 2, all alternatives meet the threshold criteria.

The alternatives were scored for each of the balancing criteria in terms of their performance relative to other alternatives. Alternatives that performed best relative to other alternatives were assigned a score of "high." Alternatives that received the best combination of relative rankings scored highest overall in the balancing criteria. Therefore, no individual criterion was weighted more heavily than others in this process.

Alternative 6A (ISCO source area treatment, MNA, and ICs) was rated highest using the balancing criteria. Alternatives 3 (MNA and ICs) and 4A (ISB source area treatment, MNA, and ICs) were rated second highest using the balancing criteria. Alternative 6B (sitewide ISCO treatment and groundwater confirmation sampling) was rated next highest using the balancing criteria. Alternative 7 (dynamic circulation source area treatment, MNA, and ICs) was rated lowest using the balancing criteria. Table ES-3 summarizes the results of the comparative analysis by balancing criteria for remedial alternatives. Table ES-4 presents a summary of comparative cost estimates for remedial alternatives.